

REMARKS

New claims 28-31 have been added to the present application. No new matter has been added. Thus, claims 1-19 and 28-31 remain pending in the present application. In the Office Action, claims 1-19 are rejected under 35 U.S.C. § 103(a) as being obvious over admitted prior art as evidenced by Choi, et al (U.S. Patent No. 4,663,191) and Holloway, et al (U.S. Patent No. 4,657,628). The Examiner's rejection is respectfully traversed.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. That is, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561 (Fed. Cir. 1986). In fact, the absence of a suggestion to combine is dispositive in an obviousness determination. *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573 (Fed. Cir. 1997). The mere fact that the prior art can be combined or modified does not make the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); M.P.E.P. § 2143.01. Third, there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); M.P.E.P. § 2142. A recent Federal Circuit case emphasizes that, in an obviousness situation, the prior art must disclose each and every element of the

claimed invention, and that any motivation to combine or modify the prior art must be based upon a suggestion in the prior art. *In re Lee*, 61 U.S.P.Q.2d 143 (Fed. Cir. 2002). Conclusory statements regarding common knowledge and common sense are insufficient to support a finding of obviousness. *Id.* at 1434-35.

With regard to independent claim 1, Applicant describes and claims forming a layer comprised of a refractory metal, determining a thickness of the layer of refractory metal, and converting a portion of the layer of refractory metal to a metal silicide. For example, a metrology tool may be used to measure the as-formed thickness of the refractory metal layer. See Patent Application, page 10, ll. 12-13. Applicant further describes and claims determining a duration of an etching process to remove unreacted portions of the refractory metal layer based upon the determined thickness of the refractory metal layer and performing the etching process for the determined duration to remove the unreacted portions of the refractory metal layer. With regard to independent claim 12, Applicant additionally describes and claims depositing the layer comprised of the refractory metal above a plurality of source/drain regions and a gate electrode of a transistor, as well as converting the portion of the layer of refractory metal to the metal silicide by performing at least one anneal process.

The admitted prior art describes forming metal silicide regions on a gate electrode and source/drain regions by depositing a layer of refractory material above the gate electrode and the source/drain regions. Unreacted portions of the refractory material are removed, typically using a dilute acid bath. See Patent Application, pg. 3, ll.8-25. In contrast to the present invention, the duration of the described chemical removal process is based upon the greatest thickness that may be anticipated by the process. See Patent Application, pg. 4, ll. 7-10. Accordingly, the Applicant's admitted prior art is completely silent with regard to determining a thickness of the

layer of refractory metal, determining a duration of an etching process to remove unreacted portions of the refractory metal layer **based upon** the determined thickness of the refractory metal layer and performing the etching process for the determined duration to remove the unreacted portions of the refractory metal layer.

Moreover, the admitted prior art contains no suggestion or motivation to modify the admitted prior art to arrive at Applicant's claimed invention. The methodologies set forth in the pending claims are fundamentally different from the prior art methodologies described in the background section of the application. For example, in situations where the layer of refractory metal is less than the maximum thickness anticipated by the design process, the methodologies set forth in the background section of the application, *i.e.* the admitted prior art, results in subjecting the device to the etching process for a duration longer than would otherwise be required to remove the unreacted portions of the layer of refractory metal. In turn, this over-etching needlessly consumes some of the thickness of the metal silicide regions, which undesirably increases the sheet resistance of the metal silicide regions.

At no point does the admitted prior art disclose or suggest determining a duration of an etching process to be performed to remove the unreacted portions of the refractory metal layer **based upon** the determined thickness of the refractory metal layer. In fact, it is believed that the duration of the etching processes for removing the unreacted refractory metal layer described in the admitted prior art were determined based upon either an assumption as to the thickness of the resulting metal silicide layer and/or the amount of unreacted material to be removed, or established for a worst-case scenario, wherein the duration was established for the largest amount of material to be removed that could reasonably be anticipated.

The Examiner relies on Choi and/or Holloway to remedy these deficiencies. In particular, the Examiner alleges that Choi and/or Holloway teach determining a thickness of a layer of refractory metal. Applicant respectfully disagrees. Choi states that the desired thickness of the silicide film is a matter of design choice. For example, the desired thickness of the silicide film may be selected based upon a desired resistivity of the silicide. For another example, the desired thickness of the silicide film may be selected based upon a desired amount of silicon which is to be consumed. See Choi, col. 6, ll. 9-12. Holloway states that a TiSi_2 thickness will be "roughly" one to two times a thickness (d1) of a titanium layer, "depending on reaction conditions." See Holloway, col. 7, ll. 50-57 and Figure 9A.

Applicant respectfully submits that Choi and Holloway are merely stating the obvious fact that the thickness of the silicide layer is a consequence of the specific formation process and/or the physical properties of the materials. Thus, Choi and Holloway teach that the thickness of the silicide layer may be anticipated based upon the parameters of the design process and, as discussed in detail above, this may result in over-etching that needlessly consumes some of the thickness of the metal silicide regions, which undesirably increases the sheet resistance of the metal silicide regions. For example, neither Choi nor Holloway teaches measuring the thickness of the silicide layer using, *e.g.*, a metrology tool.

Furthermore, Choi and Holloway are completely silent with regard to determining a duration of an etching process to remove unreacted portions of the refractory metal layer based upon the determined thickness of the refractory metal layer and performing the etching process for the determined duration to remove the unreacted portions of the refractory metal layer. Thus, Applicant respectfully submits that claims 1, 12, and all claims depending therefrom, are not obvious over Applicant's admitted prior art or any other prior art of record.

New claims 28-31 depend from independent claims 1 and 12. Thus, for at least the aforementioned reasons, Applicant respectfully submits that new claims 28-31 are allowable over the prior art of record.

For at least the aforementioned reasons, it is respectfully submitted that all claims are in condition for allowance. The Examiner is invited to call the undersigned at (713) 934-4052 to discuss any additional steps that the Examiner may consider necessary for placing the application in condition for allowance.

Respectfully submitted,

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